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Erratum: An anomaly-free atlas: charting the space of flavour-dependent gauged U(1) extensions of the Standard Model

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Abstract: We correct a statement in our original paper and add anomaly-free charge assignments for SMν_R with $7 \leq Q_{\max} \leq 10$.

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We correct a statement in the Examples paragraph of section 3.1, page 8, of ref. [1]. We wrote: "Alternatively, if we set $F_\nu = -1$, the solution in eq. (3.2) reduces to gauging $B - L$, baryon number minus lepton number within that family, as has appeared in refs. [36, 61]". The correct condition is actually $F_\nu = -3F_Q$.

We also take this opportunity to augment the results of the SMν_R scan to include $7 \leq Q_{\max} \leq 10$. These new solutions, which (together with the previous ones) can be obtained from http://doi.org/10.5281/zenodo.3345889 [2], are summarised in table 1. Figure 1 shows the number of anomaly-free solutions including $7 \leq Q_{\max} \leq 10$. We see that the previously proposed [1] "fit-by-eye" function of $12e^{7Q_{\max}/4} - 11$, while providing a good rough fit for $Q_{\max} \leq 6$, significantly overestimates the number of solutions for higher $Q_{\max}$. We provide updated versions of both plots that were in figure 1 of ref. [1] in figure 2 of this erratum, where we also propose a new fit to the true curve for the number of solutions in the SMν_R.

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$Q_{\max}$	**Solutions**	Symmetry	Quadratics	Cubics	Time/sec
7	**1358388**	2332	24616693253	241368652	312
8	**3612734**	3514	127878976089	978792750	1559
9	**9587085**	5648	558403872034	3432486128	6584
10	**21546920**	7540	2117256832910	10687426240	24748

Table 1. Number of inequivalent solutions to the anomaly equations for SMν_R fermion content and different maximum U(1)$_F$ charges $7 \leq Q_{\max} \leq 10$. Each row contains the all-zero charge solution, as well as the solutions indicated in the rows above. The column marked "Symmetry" shows how many of the solutions are charge inversion symmetric. We also list the number of quadratic and cubic anomaly equations checked by the program, as well as the real time taken for computation in seconds on a modern DELL™ XPS 13-9350 laptop.

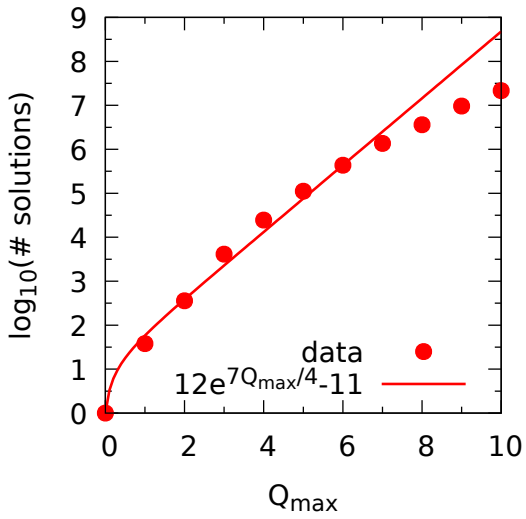

Figure 1. Number of anomaly-free solutions as a function of $Q_{\max} \leq 10$ for the SMν_R. For comparison, we show the "fit-by-eye" $12e^{7x/4} - 11$ originally suggested [1] to fit the growth of the number of solutions.

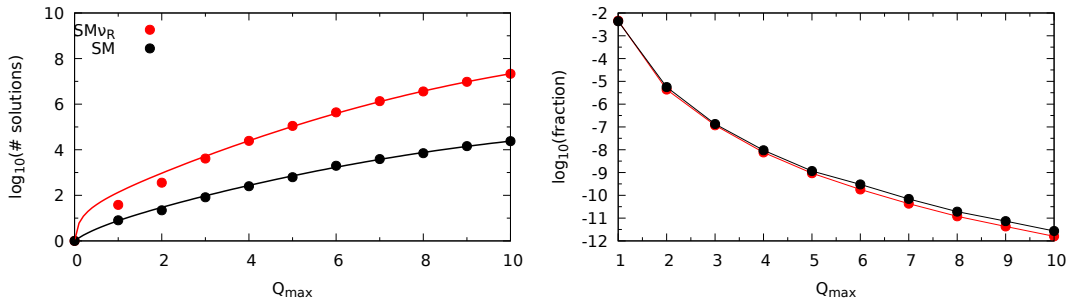

Figure 2. *Left*: the total number of inequivalent anomaly-free solutions with a given $Q_{\max}$, together with the functions $1 + a\exp(bQ_{\max} + cQ_{\max}^2) - a$ which are fit the growth of the number of solutions: $a = 22.5$, $b = 2.0$, $c = -0.062$ for the SMν_R and $a = 2.50$, $b = 1.34$, $c = -0.043$ for the SM. *Right*: the fraction of all inequivalent charge assignments which is anomaly free for a given $Q_{\max}$, showing that imposing anomaly-freedom can lead to a drastic reduction in the available parameter space.

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[1] B.C. Allanach, J. Davighi and S. Melville, *An anomaly-free atlas: charting the space of flavour-dependent gauged* U(1) *extensions of the Standard Model*, *JHEP* **02** (2019) 082 [arXiv:1812.04602] [INSPIRE].

[2] B. Allanach, J. Davighi and S. Melville, *Anomaly-free, flavour-dependent* U(1) *charge assignments for Standard Model/Standard Model plus three right-handed neutrino fermionic content*, http://doi.org/10.5281/zenodo.3345889.

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